

R&D Required to Advance Image Guidance in Medicine

Frank J. Bova - University of Florida

- **Improved intra-operative imaging to correct pre-surgical models during surgery**
- **A method of tracking of instruments and reference frames that does not depend upon line of site or is affected by local electro-magnetic environment**
- **The establishment of acceptance test procedure for data sets to be used in image guided procedures as well as acceptance test for evaluating the alignment and accuracy of fused data sets.**

Elizabeth Bullitt—UNC

Issues in IGI

- Speed and accuracy requirements
- Developmental needs for segmentation, deformable registration, new markers, handling massive volumes of data
- Validation
- Forging effective multidisciplinary links
- Working in a changing clinical environment

Marc Buntaine

President and CEO, Zmed, Inc

- Clinical benefits of image guided interventions:
 - Training of physicians and medical staff
 - Requirements of high-accuracy and simplicity of image guided systems
 - Cost and reimbursement
- Multi-modality imaging in image guided interventions:
 - Integration of 3D multi-modality imaging (CT/MR/3DUS)
 - Integration of functional/molecular imaging (PET/SPECT/FMRI)
 - Integration of real-time 2D and 3D imaging
- Virtual reality and image guided interventions
 - Artificial intelligence in imaging
 - Remote image guided interventions

Robert L. Galloway, PhD

Vanderbilt University, Department of Biomedical
Engineering, Department of Neurosurgery

- Nobody dies in image space.
 - IGI is a significantly different process than diagnosis or treatment planning.
- Image-guided interventions are mission-critical engineering.
 - Therefore they should be judged on worst-case not mean performance.
- We need assessment tools and standards.

Issues/Challenges for NIH/NSF re IGI

Marshall E. Hicks, M.D.

University of Texas, MD Anderson Cancer Center

- Merging clinical needs with available technology:
 - The videogame paradox: “My son uses more sophisticated technology in his videogames than I use to perform procedures” (or “I play videogames with my son to improve my procedure skills”)
- Overcoming the bias of operators:
 - Skill is desirable: less technology = more skill
- Transcending specialities/subspecialities:
 - Clinical focus can limit broader technology development

Most important challenges of IGT

Ferenc A. Jolesz MD.
Harvard Medical School

- Improving the combined presentation of pre-operative and real-time, intraoperative images
- Integrating imaging and treatment related technology into therapy delivery systems
- Testing the clinical utility of image guidance in surgery and cancer therapy
- Support multidisciplinary IGT Research Centers
(including infrastructure)

Peter Luyten – Philips Medical Systems

Issues in IGI

- Bridging the diagnosis – therapy gap: fusion of imaging modalities
- Challenges for the device industry to keep up with improved diagnostic imaging capabilities
- Matching new imaging technology with new interventional/therapeutic strategy (no such thing as just substituting one modality for another)

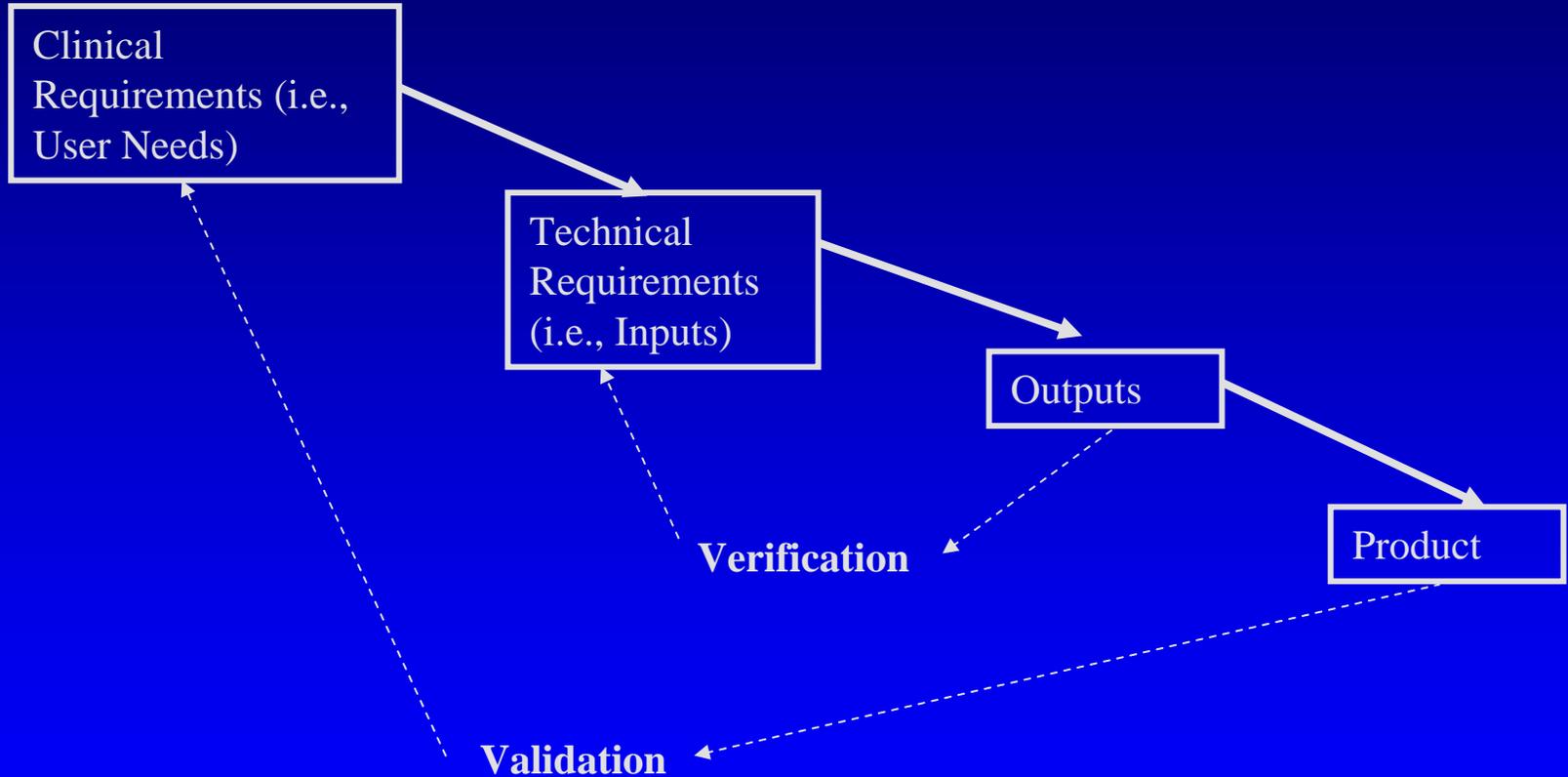
Keith Paulsen, Dartmouth

- Intraoperative compensation
- Automatic (non-contact) registration
- Non-line-of-sight, non-perturbing tracking
- Advanced, automated feature segmentation

David Simon, PhD
Medtronic Surgical Navigation Technologies
Louisville, Colorado

- How to identify the clinical accuracy requirements for a given procedure?
- How to ensure that clinical needs/requirements for a product are representative of a sufficiently large set of clinicians? How should conflicting needs/requirements be reconciled?
- How to foster a dialog that makes the connection between what's technically feasible/possible and what's clinically useful?
- How to better educate clinicians regarding technical issues and engineers/scientists regarding clinical issues?
- The design of a medical device is an iterative process which requires ongoing communication between engineers and clinicians during development. What can be done to enhance the value of the early iterations by more rapidly coming to common understanding of the device being built?
- How to discover early when the needs/requirements for a medical device are “incomplete”?

The Medical Device Development Process



Cha-Min Tang, MD PhD. Associate Professor, Dept. of
Neurology,
University of Maryland School of Medicine.

- Optical Coherence Tomography (OCT) is a novel imaging technology that has a lot to offer for image guided interventions (IGI).
- OCT is a result of the rapid advances in the field of optical fiber telecommunication.
- Can NIH/NSF serve a critical role as a catalyst for the transfer of advances in the telecom industry to medical imaging?